THE WEATHER CASE, OR FARMERS' WEATHER INDICATOR[1]

Description

STAND facing and look at the weather case. Now: The right of the case is at your right hand; the left of the case is at your left hand.

The pointer or index at the top of the case (No. 1) slides on the brass arc; it is known as the "Sunset Barometer Index," and indicates, when set by the figures to which it points on the "Main Barometer Scale," which is just below it, the reading of the barometer at the time of the sunset yesterday.

The "Main Barometer Scale" (No. 2) exhibits all the barometric readings likely to be used with this instrument.

The pointer (No. 3) just below the "main barometer scale" is called the "mean barometer index," and indicates, when set, the mean or average reading of the barometer at the place at which the instrument is set and for each separate month. When the barometer reads above or below this reading at any place, such reading is said to be "above the mean" or "below the mean" for that place in that month. This index is set once for each month in the year.

When the barometer pointers go toward the right from this mean or average reading, the barometer is said to be "rising." When the barometer pointers go toward the left from the mean or average reading, the barometer is said to be "falling."

The mean barometer reading for each district for each month is stated in the *Farmers' Bulletin*, or can be had by application to this office.

The long brass hand over the glass face of the barometer is known as the "long pointer," and indicates, by the figures of the "main barometer scale" to which it points when set, the reading of the barometer when last set.

The black pointer on the face of the barometer under the glass face is known as the "short pointer, and indicates the existing pressure of the atmosphere at any time the instrument may be examined.

To Read the Barometer

If the observer stands facing the barometer the "short pointer" (black) moves toward the right as the pressure of the atmosphere (or weight of the air) increases, and to the left as the pressure of the atmosphere (or weight of the air) diminishes. The "long pointer" (brass) should be moved by the turning screw so as to coincide with, or exactly cover, the "short pointer" (black). The barometer is now set for reading, and the "barometer reading" is found by reading from the left to right on the "main barometer scale" from the lowest figures (or readings) on that scale to that exact division or mark upon that scale to which the "long pointer" points or which it covers. The inches and hundredths of inches are marked on the scale. The inches and hundredths are counted from left to right, or in the same direction as the hands of a watch move, and they are counted in the same way as the hours and minutes on a watch-face are counted. The inches and hundredths are written down, if they are to be written, in the same manner as dollars and cents are written, thus: one dollar and seventy-five cents; that is, one dollar and seventy-five hundredths of a dollar would be written $1.75, or one and seventy-five hundredths; $29.35, twenty-nine dollars and thirty-five hundredths. The "long pointer" pointing on the "main barometer scale" to twenty-nine inches and thirty-five hundredths, the barometer-reading would be twenty-nine inches and thirty-five hundredths of an inch, and would be written "29.35 inches," and so for other readings.

[1] Circular issued by the Signal Service of the United States Army—communicated by General Myer, Chief Signal Officer.

Rain Winds and Dry Winds

There are for each place and for each month two kinds of winds:—

First—Winds which, blowing from certain directions, are at that place and in that month more likely than any other winds to be followed by rain. These are called "rain winds."

Second—Winds which, blowing from certain directions, are at that place and in that month less likely than other winds to be followed by rain. These are called "dry winds."

The "rain winds" and the "dry winds" for each district and for each month are stated in the *Farmers' Bulletin*, or can be had by application to this office.

The wind direction for any day or time must be seen and taken at each place or station by a vane as well located as practicable.

The "wind disc" (No. 8) consists of a brass circle, on which slide freely two arcs—a red arc, called the "dry-wind arc" (No. 9), and a blue arc, called the "rain-wind arc" (No. 11). In the centre of the disc is a pointer, turning with a turning-screw, and called the "wind-disc pointer" (No. 10). Around the disc are letters to show directions, as N for north, E for east, NE for north-east, &c.

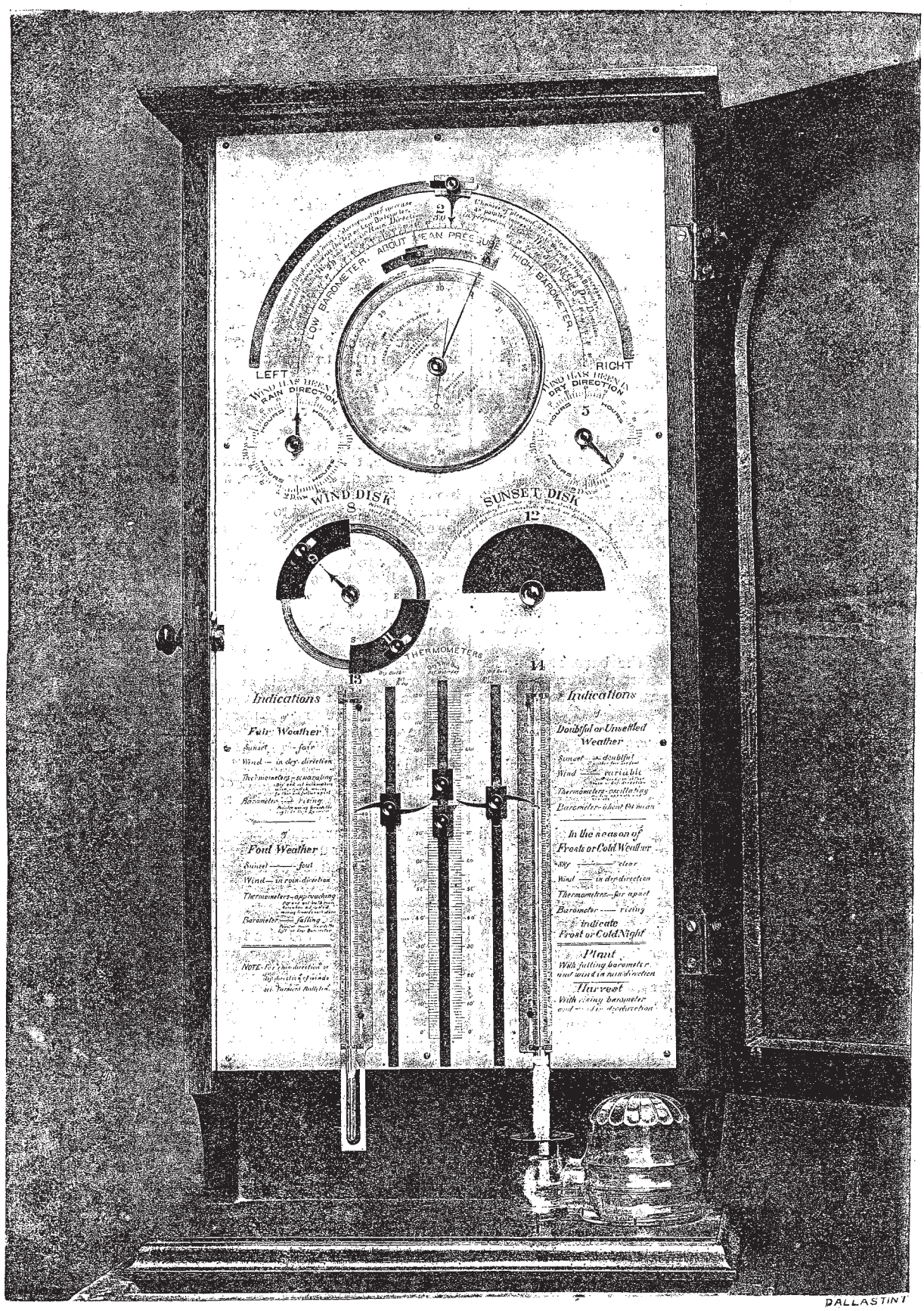
The wind disc is made ready for use as follows:—If, for instance, the *Farmers' Bulletin*, or other report, states that, for any district or place, and for any month, "winds blowing from south or east, or from directions between those points, are found to be the winds most likely to be followed by rain, winds blowing from north or west, or from directions between those points, are found to be the winds least likely to be followed by rain"—or, in other words, "winds blowing from east or south, or from directions between those points, are rain winds. Winds blowing from north or west, or from directions between those points, are dry winds;" then, if the instrument is to be used in that month and in that district or place, the rain-wind arc No. 11 (the blue) is moved on the brass circle until one end of the arc is at the letter E, which stands for "east," and the other is at the letter S, which stands for "south;" the dry-wind arc No. 9 (the red) is moved on the circle until one end of that arc is at the letter N, which stands for "north," and the other is at the letter W, which stands for "west." The arcs remain as they are thus placed for the whole of the month.

At the beginning of the next month the rain-wind direction and dry-wind direction must be located for that month, and the arcs must be again moved on the circle in the same manner until the rain-wind arc and the dry-wind arc touch, respectively, with their ends, the letters for the points named for the rain-winds and the dry-winds for that month. The arcs then remain so placed for that month—so for each month of the year.

Now, when the wind disc is thus ready, and on any day, the weather case is to be used. (1) The direction in which the wind is blowing is seen by a vane. It is noticed from what direction the wind is blowing, as from the north, south, east, &c. (2) The wind disc pointer (No. 10) is moved by the turning-screw to point to the compass-letters on the disc, or between them, showing as nearly as practicable by those letters the same direction, *i.e.*, that *from* which the wind is blowing when observed. If this pointer, so set, points at either of the ends of either arc, or any part of either arc, it shows, if it so points at the *red* arc, that the wind is at that time in the *dry*-wind direction, or is a *dry* wind; if it so points at the *blue* arc that the wind is at that time in the *rain*-wind direction, or is a *rain* wind.

The hour is noted by a clock or watch, and the time at which a rain wind or a dry wind commenced to blow, or was first noticed, is written down.

It must be also noticed if the wind shifts, as from blowing from a rain direction to blowing from a dry direction, or



is blowing from such direction as not to be within either arc.

The length of time for which the wind has blown continuously from a rain direction or a dry direction is of importance to be considered with other local signs and indications.

The pointer and scale (No. 5) on the right of and below the barometer are called the dry-wind time-record, and the pointer (No. 7) is called the "record-pointer," and indicates, when set, the length of time the wind has been blowing continuously from a "dry" direction, by the figures showing the number of hours on the scale to which it points.

The pointer and scale (No. 4) on the left of and below the barometer are called the rain-wind time-record, and the record-pointer (No. 6) indicates, when set, the length of time the wind has been blowing continuously from a "rain" direction, by the figures showing the number of hours on the scale to which it points.

The record pointer on the rain-wind time-record (No. 6) is always turned by the thumb-screw, and set pointing at the figure 0 on the scale when the wind is not blowing in the rain-wind direction. In the same way the "record-pointer" on the dry-wind time-record (No. 7) is always set pointing at the figure 0 when the wind is not blowing in the dry direction.

When in actual use, the hour at which the *wind-disc pointer* has been set is carefully noted. When the weather case is next examined, the wind-vane is again noticed, and the wind-disc pointer again *examined* or adjusted. If it still continues to point at any part of the same arc as before, the number of hours which have elapsed since the last setting and during which the wind-disc pointer has been so pointing is noticed, and the record-pointer on either the rain-wind time-record or dry-wind time-record is turned to show the *number of hours* the wind has been thus noticed as blowing from the *rain* direction or from the *dry* direction, as the case may be. This proceeding is repeated every time the instrument is set. It can thus be seen at a glance whether the wind is, or not, blowing in a rain-wind or a dry-wind direction, and for how long it has been so blowing. Whenever, on noticing the wind-vane, it is seen that the wind has shifted, the wind-disc pointer is set accordingly If it now points at neither arc, or points to the different arc from that at which it pointed at its last setting, the time-record pointer on the rain-wind time-record or dry-wind time-record (whichever may have been in use at the last setting), is turned to point at the figure 0 (zero).

The wind-disc pointer and the time-record pointer ought to be set thrice daily at least, early in the morning, at noon, and at sunset.

The sunset-disc (No. 12) consists of a circular disc, one half of which is coloured red and one half of which is coloured blue. The disc turns upon a central turning-screw in such manner that half of the disc shows through a semi-circular opening in the face of the weather-case. The sunset-disc is set as follows :—At the exact time of every sunset the western sky and the character of the sunset is carefully observed. The examination ought to be minute and careful, lasting for about fifteen minutes. If the sunset sky is clear or red, or markedly what is known as a "fair weather sunset"—a sunset such as is generally held to indicate a clear or fair day to follow on the next day, a day on which it will not rain—the sunset-disc is turned by the turning screw until the semi-circular opening shows all red. The sunset-disc, thus turned, is described as set for a "fair weather sunset."

If the sunset sky (the western) is cloudy or foul, or markedly what is known as a "foul weather sunset," a sunset such as is generally held to indicate foul weather to follow on the next day—a day on which it will rain—the sunset-disc is turned by the turning screw until the semi-circular opening shows all blue. The sunset-disc thus turned, is described as set for a "foul weather sunset." If the appearance of the western sky and the character of the sunset are neither markedly those of a "fair weather sunset" or of a "foul weather sunset," but such as to leave the observer in doubt how to style it, the sunset-disc is turned to show half red and half blue, or "doubtful." The sunset-disc, thus set, is described as set for a "doubtful weather sunset."

The term "fair weather sunset" expresses such condition of the sky, particularly the western, and such character of the sunset, as is considered to indicate a fair day, a day on which it does not rain, for the day ensuing.

The term "foul weather sunset" indicates that the appearances are such as to presage a rainy day, a day on which rain falls, for the ensuing day.

The term "doubtful weather sunset" indicates that the conditions are such as to leave the mind of the observer in doubt as to what the sunset presages for the following day. The indication is considered to be for the period of time from the "sunset" of the day on which the character of the sunset is examined until the "sunset" of the following day.

Dry-bulb and Wet-bulb Thermometers

In the lower part of the weather case there are two thermometers, a dry-bulb thermometer (No. 13) on the left-hand side of the case, and a wet-bulb thermometer (No. 14) on the right-hand side.

The dry-bulb thermometer is like any other thermometer, and shows by its readings the temperature of the air.

The wet-bulb thermometer is one, the bulb of which is kept constantly moist by the water passing up from the glass reservoir, through the wicking which covers the thermometer bulb.

The readings of the dry-bulb thermometer and those of the wet-bulb thermometer, are more and more unlike, or farther and farther "*apart*," as it is called, in proportion as the air contains less and less moisture; that is, is becoming *dryer*.

The readings of the dry-bulb thermometer and those of the wet-bulb thermometer become more and more *alike*—are nearer and nearer together—in proportion as the air contains more and more *moisture*; that is, is becoming saturated or *wet*.

By the side of the dry-bulb thermometer (No. 13) is the dry-bulb pointer which slides on the brass slide (No. 15). By the side of the wet-bulb thermometer is the wet-bulb pointer which slides on the brass slide (No. 16). In the centre of the case is the "dry- and wet-bulb scale," marked on the paper on which is the central brass slide-bar (No. 19), and on this slide move the dry-bulb keeper (No. 17) and the wet-bulb keeper (No. 18). To set the thermometers examine first the dry-bulb thermometer and move the "dry-bulb pointer" (No. 15) on the slide until the outside point is exactly level with the top of the mercury in the thermometer—as near to it as practicable. Examine next the wet-bulb thermometer, and move the wet-bulb pointer (No. 16) on the slide until the outside pointer is exactly level with the top of the mercury in the wet-bulb thermometer, or as near to it as practicable, then turn to the "dry- and wet-bulb scale," and on the "central brass slide-bar" (No. 19) move one of the keepers until it touches, as nearly as possible—is on an exact level with the inside pointer of the "dry-bulb pointer," then move the other keeper until it touches, as nearly as practicable—is on an exact level with the inside pointer of the "wet-bulb pointer." The thermometers are now set, and the difference between their readings can be known by counting on the "dry- and wet-bulb scale" the number of degrees between the keepers.

When the thermometers are examined and set again, following the same plan, it will be easily seen whether the

"keepers" are, when set, *farther apart* than they were at the previous setting, or whether they are, when set, *nearer together* than at the previous setting.

If they are farther apart the thermometers are said to be "separating." If they are nearer together the thermometers are said to be "approaching." Other things being equal, the thermometers show, when they are "separating," that the air is becoming more dry—one sign of approaching fair weather. The thermometers show, when they are "approaching," that the air is becoming more moist or damp—one sign of approaching rain.

The reservoir at the bottom of the weather case ought to be kept half filled always with pure water. The wicking must be kept clean and changed occasionally—say, once in each month.

Uses of the Weather Case

The weather case is not intended to be used independently of the official weather reports. It is to be used always in connection with them. The weather case is for the purpose of supplementing the official reports by showing the local instrumental indications, and giving other information. It is intended especially for use at Farmers' Post Offices and places reached with difficulty by the printed reports. It will supplement often whatever knowledge there be of local signs, with the indications of the instruments. Its careful use taken either with the furnished reports or even without them (if they chance to fail), will often enable the character of the coming weather on the coming day to be so judged as to determine what kind of work or undertaking it is wise to plan for or to omit. The case gives the local instrumental indications, and will frequently aid in making fair forecasts for the next day.

It is well to limit the forecasting to the attempt to tell only whether it will or will not *rain* on the next day. Days on which it does not rain at all, are rated "fair," though the sky may be covered with clouds. Days on which there is rain enough to injure crops in the harvesting, are rated "foul."

It must never be forgotten that the weather case is only to aid, sometimes, in making up one's mind as to what the weather of the next day will be. While it will often be very useful, there will be many instances in which everything will be left in doubt.

Location

The weather case should be hung or stand in a fair light, where it will be always shaded, preferably on the northern side or part of the house, where it will not be exposed to artificial heat, and where there will be a free circulation of the air. It will be easier to find good locations in summer than in winter. As the readings of the instruments are examined for their general indications only, the great care as to the location will not be so needed for general use as if the readings were for exact record. For particular uses, the case may be particularly sheltered.

To Use the Weather Case at Sunset

(1) Read the description: See that the mean barometer index is set to the mean barometer reading for the place and for the month.

(2) Set the rain wind segment (or arc) and the dry wind segment (or arc) at the proper places on the wind-disc circle for the place and month.

At sunset turn the "long barometer pointer" until it covers the "short barometer pointer." Note whether on the "main barometer scale" the long pointer is then at a reading *above* or *below* (greater or less than) the mean barometer reading for the place and for the month. Move the "sunset barometer index" until it points to the same reading on the "main barometer scale" with the "long barometer pointer."

Note the direction of the wind and set the wind-disc pointer.

Set the sunset-disc.

Set the dry- and wet-bulb thermometers.

Endeavour to apply the "indications" printed on the face of the case, to determine what is to be the character of the next day. Read these "indications" carefully, and see how many of the instruments or discs *agree* in showing one or another kind of weather as to be expected.

Study the character of the clouds. The scud cloud is one of the prominent signs of coming rain. Learn to apply the local signs of weather changes, the more the better.

Examine the case frequently during the day.

It can always be found whether the "pointer" is moving toward the right or left—that is, whether the barometer is rising or falling—by turning the long pointer, so as to cover exactly the black barometer pointer; if then, on next examination, the black pointer is found to have moved toward the right, the barometer is rising. If the black pointer has moved toward the left, the barometer is falling.

At sunset of the next day set the case again; note whether the barometer has risen since the "Sunset Barometer Index" was set at the last sunset, whether the wind is in the rain or the dry direction, and for how many hours it has been in either, approximately. Study and record the character of the sunset and what it foretells. Set the wet- and dry-bulb thermometer, and note from the "keepers" whether the thermometers are approaching or separating.

Endeavour to make a forecast whether it WILL or NOT rain for the ensuing day, as well as a more general forecast.

For instance, if with a "fair weather sunset" there is a "high and rising barometer," "winds in dry direction," and "thermometers separating," the chances for a fair day for the next ensuing are increased; four indications of pleasant weather coincide. If, with a "foul weather sunset," the barometer is falling" (the pointer moving toward the left), the winds are in the rain-wind direction, and "thermometers approaching," four indications of rainy or unpleasant weather coincide. So three indications may coincide, as, with "thermometers approaching" there may be "fair weather sunset"—barometer pointer moving toward the right or high barometer—wind steady in the dry direction. The indications may be divided. In such cases weight must be given the different indications as experience may show their correctness. The purpose of the case is to be one aid only in making up a forecast.

The greater the number of the "indications," as stated on the face of the case, which are found when the instrument is set, to coincide in indicating dry or clear weather, or rainy or stormy weather, the more likely the success of the forecast.

Continue this practice at sunset from day to day. Skill will be found to increase with the knowledge and the use of the instrument and the habit of close observation of local signs which such use makes necessary.

In instances where the printed synopses and indications are had regularly, or where official weather charts, bulletins, &c., can be consulted, the weather case must be used with careful study of those papers. Locate the areas of high and low barometer on the map, and in reference to any location, as nearly as is practicable from the descriptions or data. Areas of cloudiness, rain-areas, areas of unusual temperature, &c., may be similarly located. When any such areas are found to the westward of and at all near any place, it is rare that the effects of them fail to be shown at such place by weather conditions similar to those within the areas noticed, and in a short time, as of hours or days. As the movements of the

areas, easterly, have a certain regularity, it is soon learned to tell nearly *when* the effect of any area noticed as approaching will commence to be felt. The instrumental signs of the weather case will show the changes commencing, and it may be judged whether or when the weather conditions noticed in the approaching area are likely to prevail. Some elementary knowledge of meteorology is needed; but much can be done by a careful watching, solely. The instruments of the weather case will show the changes anticipated when they begin to be felt and before they have arrived in their full force.

If the area noticed has been large or small, with weather conditions decided or variable, it can, from these facts, be judged often if the "coming weather," of whatever kind it may be, will be steady for a day or for days, or more rapidly changing. The case makes practicable other and many studies.

ALBERT J. MYER,
Brig.-Gen. (Brevet Assg'd.), Chief Signal Officer, U.S.A.

WAR DEPARTMENT,
Office of the Chief Signal Officer,
Washington, D. C., July 21, 1878

ARE THE "ELEMENTS" ELEMENTARY?[1]

II.

IT would be a curious speculation were one to ask one's self what *is* the atomic weight of ozone? Is it 24? Is its atomic formula $O_{1\cdot5}$? or has oxygen the atomic weight of 32 and ozone of 48, and are the molecular weights 64 and 96 respectively? This can scarcely be, for the smallest amount of oxygen in two volumes of a gaseous compound of that element is certainly not 32, but 16 parts by weight. In fact *atoms* of allotropes scarcely appear to exist, the molecule appears to be the smallest amount of one of these substances that can exist either in, or out of combination. But can elements really exist in combination under various allotropic forms? We do not know. Weber thinks they can, Clarke thinks they cannot. The example of graphitic acid sometimes cited as proof of the existence in the combined form of allotropic carbon does not appear to me to *prove* either one view or the other. Graphite, may we not say, is an intermediate stage in the formation of graphitic acid from carbon? But it does not follow that the carbon in that acid is in a form different from that under which it exists, say in sugar. But it is exceedingly difficult, as yet, to attach a definite meaning to such a statement as "Carbon exists *under different forms* in this and in that compound."

The specific heats of allotropes vary. Weber has most carefully determined the specific heats of the modifications of carbon and boron. The numbers obtained at low temperatures are different, but when we come to those temperatures at which optical differences disappear, we find that differences in specific heats disappear also. At high temperatures there is but one specific heat for carbon and but one for boron; at low temperatures there are two or more specific heats for each. This seems to mean that at sufficiently high temperatures there is but one form of carbon and but one form of boron. As we do not know the atomic or molecular weights of the allotropic modifications of these elements, we can, it seems to me, draw no conclusions of any value concerning the atomic heats of these allotropes, and therefore the fact that the atomic heat of the elements is a constant number may be explained equally well on the hypothesis that the elements are all allotropes of one of themselves, or of an unknown substance, and on the hypothesis that the elements are essentially distinct forms of matter. It is well to bear in mind that, so far as our knowledge of allotropy goes—and it goes but a very little way—we have reason to believe that each allotrope has a different molecular, and therefore, probably, a different atomic weight, from every other allotrope of the same element; and, further, that we know that allotropes are at high temperatures resolved into one and the same form. Phosphorus has an abnormal vapour density: two volumes of the vapour of this body contain four (relative to hydrogen as two) atoms; red phosphorus (P_β) changes into common phosphorus (P_α) at comparatively low temperatures, therefore we do not know the vapour density of P_β. At a point not far from its boiling point, two volumes of the vapour of sulphur contain six atoms (if S = 32); at a higher temperature two volumes contain two atoms. We appear to have here a real gaseous allotrope. Is it analogous with ozone? Is it not therefore probable that the densities of P_α and P_β would be found to be different, supposing they were both obtained as vapours? But even P_α is abnormal. May it not be, then, that we have not as yet obtained normal phosphorus at all? That what we call phosphorus is an allotrope of the true phosphorus, viz., P_β? May it not be that at very high temperatures P_α splits up and yields true normal phosphorous vapour? Now let us briefly glance at isomers, or compounds having the same composition, but with different molecular weights. The mere fact that compounds of the same composition, but different molecular weights, exist, especially when taken in conjunction with the further fact that different compounds having the same composition and the *same* molecular weights also exist, renders the theory that the elements are really compound bodies not altogether improbable. So little has been done in the way of exact determinations of the specific heats, specific volumes, and other physical constants, of isomeric bodies, that I forbear from pressing the facts that are known into the argument, but content myself with saying that a more or less simple relation appears to exist between the physical and the chemical nature of the various isomers. The generally accepted theory of isomerism seeks to account for the facts by supposing that the atoms of isomers having equal molecular weights are differently arranged: another theory—to me it appears that the one theory is complementary of the other—supposes that the differences in the action of isomers are to be traced to differences in the amounts of "energy" possessed by these isomers (would it not be better to say, to differences in the relations between the potential and kinetic energy of isomers, and also perhaps to differences in total energy?); whichever theory is applied to isomers may be equally applied to the elements, on the assumption that these bodies are really compounds of one simple form of matter.

The positive evidence in favour of the theory of the non-elementary nature of the so-called elements is not very great. Yet, to say that the elements *are* truly elementary is, I am persuaded, a statement which is not justified by the facts which we possess. Either hypothesis may be adopted as a working hypothesis: the former, that the elements are *not* elementary, is, it seems to me, likely to lead to more discoveries, and to pave the way to more far-reaching generalisations than the latter.

But why should no one have succeeded in decomposing one of the so-called elements? In a sense we have succeeded. Ozone is an element, but it can be decomposed. Oxygen may, I think, be said to be a simpler form of matter than ozone. The introduction of the battery into chemistry led to the decomposition of potash and soda; the introduction of new engines of research may lead to the decomposition of some of those bodies, our conclusions regarding the elementary nature of which rests upon the same kind of evidence as did the conclusions regarding the elementary nature of potash and soda before the experiments of Sir Humphrey Davy. Analogy prompts us to ask, Is it not possible that what we cannot accomplish in our earthly laboratories may be actually brought about

[1] A paper read before the Owens College Chemical Society. Continued from p. 593.